

Remarks:

Reconsideration of the application is requested.

Claims 1-5 and 11-24 are now in the application. Claims 1, 3-5 and 11 have been amended. Claims 6-10 have been cancelled. Claims 12-24 have been added.

Support for the subject-matter of newly added claims 12-13 and 18-19 can be found on page 12, lines 23-24, page 7, line 4, and page 8, line 2, of the specification.

Support for the subject-matter of newly added claims 14 and 20 can be found on page 13, lines 16-20, of the specification.

Support for the subject-matter of newly added claims 15 and 21 can be found on page 4, lines 19-20, of the specification.

Support for the subject-matter of newly added claims 16 and 22 can be found in claim 3 as originally filed.

Support for the subject-matter of newly added claims 17 and 23 can be found in claim 1 as originally filed.

Support for the subject-matter of newly added claim 24 can be found in claim 2 as originally filed.

In item 1 on page 2 of the above-identified Office action, the Examiner stated that "Applicant's election of Group I, claims 1-8 in Paper No. 8 is acknowledged."

The inventive concept of the invention of the instant application is to use a **combination** of conductive material **and** small balls in order to achieve a comparatively good mechanical decoupling of a semiconductor component from a printed circuit board when the semiconductor component is soldered onto the printed circuit board. Although the use of solder paste or a conductive adhesive may not be interchangeable without possibly having to use different small balls with a different elasticity or a different thickness of the second insulating layer for a desired mechanical decoupling, it is believed not to be "patentable distinct" (for the present invention) whether the conductive material is a solder paste or a conductive adhesive. Consequently, the Examiner is requested to review the restriction requirement made in the Office action dated February 19, 2002.

If the Examiner maintains the restriction requirement, Applicants confirms the election of group I (conductive adhesive). The following claims read on group I: claims 1-5, 13-17, and 19-24.

In item 3 on page 2 of the Office action, claims 1-5 have been rejected as being indefinite under 35 U.S.C. § 112, second paragraph. The Examiner's comments have been noted and claims 1 and 3 have been amended by deleting any reference to a "cylinder shape" or "cylinder". It is accordingly believed that the claims meet the requirements of 35 U.S.C. § 112, second paragraph.

Should the Examiner find any further objectionable items, Counsel would appreciate a telephone call during which the matter may be resolved. The above-noted changes to claims 1 and 3 are provided solely for the purpose of satisfying formal requirements or for cosmetic reasons. The changes are neither provided for overcoming the prior art nor do they narrow the scope of the claims for any reason related to the statutory requirements for a patent.

In item 5 on page 3 of the Office action, claims 1-8 have been rejected as being obvious over *Akagawa et al.* (EP 0 734 059) in view of *Farnworth et al.* (US 6,639,600) and *IBM Technical Bulletin*, "Solder Plated Resin Ball", Vol. 38, pages 463-464 (May 1995), under 35 U.S.C. § 103.

The rejection has been noted and claims 1 and 3 have been amended in an effort to even more clearly define the invention of the instant application. Support for changes to claims 1

and 3 can be found on page 2, lines 17-19, ("comparatively good mechanical decoupling from a printed circuit board when the semiconductor component is soldered onto the printed circuit board") and on page 12, lines 23-24, ("the opening 9 is filled with a conductive material 11, which may be a solder paste or a conductive adhesive").

Before discussing the prior art in detail, it is believed that a brief review of the invention as claimed, would be helpful.

Claim 1 (similarly claim 3) as amended calls for, inter alia:

a chip;

electrical connection pads disposed on said chip;

at least one first insulating layer disposed on said chip such that said electrical connection pads are free of said first insulating layer on at least one surface;

interconnects running on said first insulating layer and in each case lead from said electrical connection pads to base regions;

a second insulating layer disposed on said interconnects and on said first insulating layer, said second insulating layer having a thickness, said second insulating layer having openings formed therein leading to said base regions;

a conductive material with an elasticity, introduced into each of said openings;

small balls having a metallic coating on an outside and an elasticity disposed on said conductive material in a region of a free end of each of said openings; and

said thickness of said second insulating layer, said elasticity of said conductive material, and said elasticity of said small balls **resulting in a desired comparatively good mechanical decoupling** from a printed circuit board upon the semiconductor component being soldered onto the printed circuit board.

The inventive concept of the invention of the instant application is to use a combination of conductive material and small balls in order to achieve a comparatively good mechanical decoupling of a semiconductor component from a printed circuit board when the semiconductor component is soldered onto the printed circuit board.

In the last paragraph on page 3 of the Office action, the Examiner stated that "[i]t is well known and conventional in the semiconductor art to use plastic balls having a metallic coating and an outer solder coating in place of pure solder balls because the plastic is more reliable to withstand **thermal stress**, as shown for example in IBM Technical Bulletin, "Solder Plated Resin Ball" page 463." (emphasis added). However, the purpose of the balls in the present invention is to achieve, in combination with the appropriately

selected conductive material, a comparatively good ***mechanical decoupling***.

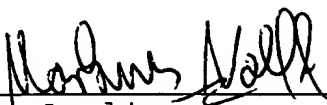
None of references suggest using a combination of conductive material and small balls in order to achieve a comparatively good mechanical decoupling from a printed circuit board when a semiconductor component is soldered onto the printed circuit board. Therefore, the invention as recited in claims 1 and 3 of the instant application is believed not to be obvious over the applied references.

It is accordingly believed to be clear that *Akagawa et al.* in view of *Farnworth et al.* and *IBM Technical Bulletin "Solder Plated Resin Ball"* do not suggest the features of claims 1 and 3. Claims 1 and 3 are, therefore, believed to be patentable over the art and since claims 2, 4-5, and 11-24 are ultimately dependent on either claim 1 or claim 3, they are believed to be patentable as well.

In view of the foregoing, reconsideration and allowance of claims 1-5 and 11-24 are solicited.

Please charge any fees which might be due with respect to Sections 1.16 and 1.17 to the Deposit Account of Lerner and Greenberg, P.A., No. 12-1099.

Respectfully submitted,

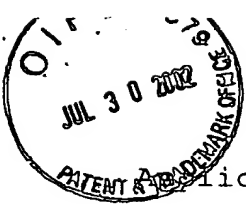

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Patent Application No. : 09/761,594

Version with markings to show changes made:

Claim 1 (amended). A semiconductor device in chip format,
comprising:

a chip;

electrical connection pads disposed on said chip;

at least one first insulating layer disposed on said chip such
that said electrical connection pads are free of said first
insulating layer on at least one surface;

interconnects running on said first insulating layer and in
each case lead from said electrical connection pads to base
regions;

a second insulating layer disposed on said interconnects and
on said first insulating layer, said second insulating layer
having a thickness [being thicker than said first insulating
layer], said second insulating layer [have] having openings
formed therein [and each of said openings leads] leading to [a
respective one of] said base regions;

[cylinders made of a cured, elastic] a conductive [adhesive]
material with an elasticity, [disposed in] introduced into
each of said openings;

small [plastic] balls having a metallic coating on an outside and an elasticity disposed [in each case] on [a respective one of said cylinders made of said cured, elastic conductive adhesive] said conductive material in a region of a free end of each of said openings; and

said thickness of said second insulating layer, said elasticity of said conductive material, and said elasticity of said small balls resulting in a desired comparatively good mechanical decoupling from a printed circuit board upon the semiconductor component being soldered onto the printed circuit board.

Claim 3 (amended). A method for producing semiconductor devices in a chip format, which comprises:

providing chips;

placing electrical connection pads on the chips;

applying at least one first insulating layer to at least one surface of the chips such that the electrical connection pads are left at least partially uncovered by the first insulating layer;

producing interconnects on the at least one first insulating layer, the interconnects leading to base regions of external connection elements;

applying a second insulating layer on the interconnects and on the at least one first insulating layer, the second insulating layer having a thickness [being thicker than the first insulating layer];

forming openings in the second insulating layer above the base regions and leading to the base regions;

introducing a conductive [adhesive] material with an elasticity into the openings [and the conductive adhesive having a cylinder shape in the openings];

placing small [plastic] balls having a metallic coating on the outside and an elasticity onto the conductive [adhesive] material in a region of a free end of each of the openings; and

[curing the conductive adhesive] the thickness of said second insulating layer, the elasticity of the conductive material, and the elasticity of the small balls resulting in a desired comparatively good mechanical decoupling from a printed circuit board upon the semiconductor component being soldered onto the printed circuit board.

Claim 4 (amended). The method according to claim 3, which comprises using a doctor blade for introducing the conductive [adhesive] material into the openings.

Claim 5 (amended). The method according to claim [3] 19,
which comprises

forming the chips on a wafer; and

after the curing of the conductive adhesive [step], dividing
the wafer to obtain the semiconductor devices.

Claim 11 (amended). The method according to claim [9] 18,
which comprises:

forming the chips on a wafer; and

after the remelting of the solder paste [step], dividing the
wafer to obtain the semiconductor devices.